

## **REMARKS/ARGUMENTS**

### **Regarding the amendments**

Claim 1 has been limited to specify the use of novolac type epoxy resins and further specify the compounds with which the epoxy resins are modified. Basis for the specified novolac type epoxy resin structures can be found in original Claim 5 and discussed further in the application at page 7, line 32 through page 9, line 4. Basis for the epoxy resin modifiers can be found on page 9, lines 10 to 17 of the application as filed.

Claims 1 and 11 have also been restricted to specify a maximum residual epoxy amount of less than 10%, based on page 7, line 19 and original Claim 10 of the application as filed.

The further amendments to Claim 11 are editorial to provide consistency with Claim 1.

Claim 21 has been added to further specify a specific listing of the epoxy modifier compounds based on the specific compounds that are disclosed in the application as filed at page 9 lines 10 through 16.

### **Regarding the Specification Objections**

In response to the Examiner's objection the "Fig. 1" and "Fig. 2" figure headings have been removed from the structures shown on pages 8 and 9 of the specification. This is believed to remove the objection to the disclosure.

### **Regarding the Claim Objections**

The objection to Claim 5 is believed to be removed by its cancellation.

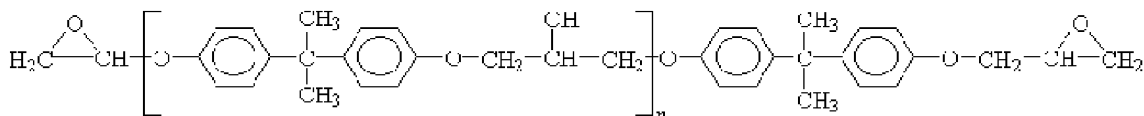
### **Regarding the Claim Rejections**

Claims 1-4, 6-10, and 19 are rejected under 35 USC 102/103 as anticipated/obvious in view of JP 2000-309,699A by Higaki ("Higaki").

Higaki teaches ignition resistant resins/blends where the ignition resistance additive formulation can include an epoxy resin. However, it does not teach the specific novolac type

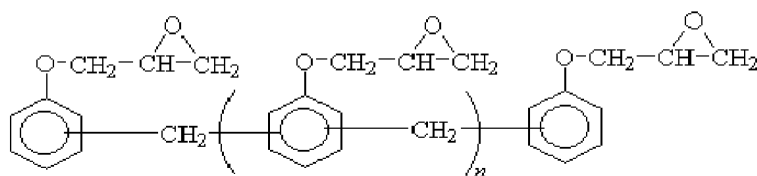
of epoxy resin required by Applicants' claims as amended nor the further modification of that epoxy resin as required for Component B in our claimed composition.

In paragraph 56 of Higaki the specifically taught and preferred epoxy and phenoxy resins "are formed of a condensation reaction of bisphenol A and epichlorohydrin". These Higaki teachings provide bisphenol-A diglycidyl ether epoxy resins having the general structure:



As can be seen, there will be no more than two functional epoxy groups per molecule and the monomer aromatic rings are bonded together by the diglycidyl ether units. These are clearly not the type of novolac epoxy resins as now required according to Applicants' invention.

The epoxy resins as now specified for the present invention are glycidyl ethers of phenolic novolac resins having a different structure and obtained by a different reaction and process. For making an novolac epoxy resin, phenols are first reacted in excess, with formaldehyde to produce phenolic novolac resin. Then, the novolac resins are reacted with epichlorohydrin to provide the general novolac epoxy resin structure:



As can be seen, novolac epoxy resins generally contain multiple epoxide groups. The multiple epoxide groups provide multiple reactive sites for further derivative formation as further required according to the present invention. In addition, in the claimed novolac epoxy resins, the required CH<sub>2</sub> linkages between the monomer aromatic rings provide much better heat stability and char forming performance than would be provided using the bisphenol-A diglycidyl ether epoxy resins specified by Higaki.

Furthermore, there is no teaching or suggestion in Higaki to modify the epoxy groups in any way nor to use an epoxy-reactive modifier selected from the groups specified in Claims 1 and

21. As discussed in the present application at page 1, lines 28 and 29; page 2, lines 19 through 24; and shown in the Table on page 18, the modified epoxy resins provide better combinations of resin properties than epoxy resins that are left unmodified. The improvements include reduction of black specs and benefits in the processing and performance of the resin. Note the comparison in the table between Example 1, a resin according to the invention where the epoxy resin is modified with 2-phenylphenol, and the third comparative example in the last column where there is no modification of the epoxy resin. The resin according to the invention has improved processability (Melt Flow Rate), Izod, and elongation.

Therefore, it can clearly be seen that Higaki neither teaches nor suggests the claimed invention.

Claims 1 through 20 are rejected under 35 USC 102/103 as anticipated/obvious over WO 02/100947 of Yang et al. ("Yang"). Regarding Yang, it teaches ignition resistant resin formulations that contain a phenol resin derivative. These derivatives would include an multi-epoxy-functional derivative as shown by Formula VIII on page 11 which would correspond generally to a **precursor** for the modified epoxy novolac resin used according to the present invention. However, Yang clearly does not teach the further modification of that epoxy derivative as required for Component B in our claimed composition nor use of the specific modifiers required according to Applicants' Claims 1 and 21.

Claims 1 through 20 are rejected under 35 USC 103 as being unpatentable over WO 02/12393 of Matsumoto ("Matsumoto") in view of USP 5,641,839 to Asano et al. ("Asano"). Matsumoto teaches flame retardant resin compositions containing an aromatic phosphate and an epoxy-modified phenolic resin that would correspond to a **precursor** for the modified epoxy novolac resin used according to the present invention. Asano teaches that a monohydric or dihydric aliphatic alcohol can be used to decrease the epoxy functional group density in a novolac epoxy resin for use in thermoset encapsulating materials. The objective in Asano is slightly reducing the functional group content to reduce the cross-link density and reduce the modulus of the resulting thermoset resin. The Examiner maintains that these teachings are then applicable to modify the ignition resistance additive taught in Matsumoto.

Upon a more complete review of Asano, however, it is clear that these teachings do not suggest modification of novolac epoxy resin flame retardant additives nor do they use the modifiers specified according to Applicants' claims. Initially, it is noted that the aliphatic alcohol modifiers taught by Asano do not teach or suggest any of the specified modifiers according to Applicants' Claims 1 and 21. Furthermore, the teaching in Asano to modify an epoxidized novolac resin is specific to their further use in thermosetting applications where the resins are then combined with a hardener and accelerator (and a further fire retardant agent) to provide cured thermoset resins. The Asano modification is taught to obtain property modification in the final thermoset resin. No one of ordinary skill in the art would apply this to a novolac epoxy resin used as an ignition resistance additive (without any hardener or accelerator) in a thermoplastic resin.

Again, attention is directed to the present application at the Table on page 18 where it is shown that the modified epoxy resins provide better combinations of resin properties than epoxy resins that are left unmodified. Note the comparison in the table between Example 1, a resin according to the invention where the epoxy resin is modified with 2-phenylphenol, and the third comparative example in the last column where there is no modification of the epoxy resin. The resin according the invention has improved processability (Melt Flow Rate), Izod, and elongation.

In conclusion, it has been shown that none of the cited references either teach or suggest the claimed compositions. Therefore, in view of the above amendments and remarks responsive to all the grounds of rejection, it is believed that the pending application is in condition for allowance. Please feel free to contact the Applicant's undersigned representative if there any questions.

Respectfully submitted,

/Jonathan W. Morse/  
Jonathan W. Morse  
Registration No. 30,200  
Phone: 989-636-8298

P. O. Box 1967  
Midland, MI 48641-1967  
JWM/mlv